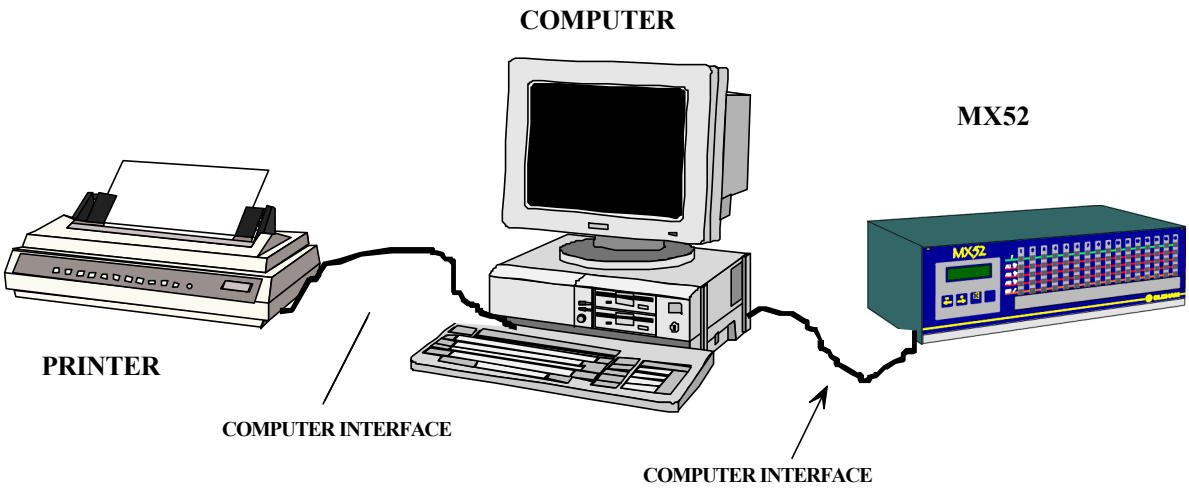
USER MANUAL

English

for "RS 485" OUTPUT of MX48 and MX52 DETECTION UNITS under the MODBUS/JBUS PROTOCOL



AFAQ ISO 9001

CE Fabrication française

OLDHAM

DETECTION GAZ / MESURE A L'EMISSION

GAS DETECTION / STACK GAS MONITORING

OLDHAM SA

GAS AND FLAME DETECTION

STACK *GAS* AND *DUST* MONITORING

We thank you for choosing an **OLDHAM SA** instrument.

We have taken every step to ensure that this equipment continues to give you complete satisfaction.

Please read the instruction manual carefully before using the instrument.

OLDHAM
DETECTION GAZ / MESURE A L'EMISSION
GAS DETECTION / STACK GAS MONITORING

L I M I T S O F R E S P O N S I B I L I T Y

* **OLDHAM SA** hereby rejects any and all responsibility with regard to any person for material damage, bodily injury or death resulting in whole or in part from the inappropriate use, installation or storage of its equipment not conforming to the instructions and to warnings and/or not conforming to standards and regulations in force.

* **OLDHAM SA** does not allow or authorize any company, person or legal entity to assume such responsibility on the part of **OLDHAM SA**, even if involved in the sale of the products of **OLDHAM SA**.

* **OLDHAM SA** shall not be liable for any direct or indirect damage, or any direct or indirect legally awarded damages resulting from the sale and use of any of its products, **UNLESS THOSE PRODUCTS WERE SPECIFIED AND CHOSEN BY OLDHAM SA FOR THE USE MADE OF THEM.**

O W N E R S H I P C L A U S E S

* Sketches, drawings, specifications and data included herein contain confidential information which is the property of **OLDHAM SA**.

* These information shall not be, in part or in whole, physically, electronically or in any other form whatsoever, reproduced, copied, divulged, translated, used as a basis for the manufacture or sale of **OLDHAM SA** equipment or used for any other reason **without the prior approval of OLDHAM SA.**

W A R N I N G S

* This document is not a contractually binding document, **OLDHAM SA** reserves the right to make any changes, without notice, to the technical characteristics of its equipment in order to improve performance levels, in the interest of its customers.

* **CAREFULLY READ THE INSTRUCTIONS BEFORE ALL FIRST USE:**
  This instruction manual must be read by any person who is, or will be, responsible for the use, maintenance or repair of this equipment.

* **This equipment will conform with the specified performance levels only if it is used, maintained and repaired in accordance with the directives of OLDHAM SA and by OLDHAM SA personnel or personnel authorized by OLDHAM SA.**

CONTENTS

INTRODUCTION.....6

I. THE MODBUS PROTOCOL.....7

1. DEFINITION OF A PROTOCOL.....7

1.1. General features.....7

2. OUTLINE OF THE MODBUS PROTOCOL.....9

2.1. BASICS.....9

3. BASICS OF MODBUS EXCHANGES.....10

II. PROTOCOL MANAGEMENT.....11

1. IMAGES OF THE MODBUS OBJECTS.....11

1.1. Definition.....11

2. MASTER/SLAVE EXCHANGES.....11

2.1. Basics.....11

3. DETAILS OF THE FUNCTIONS SUPPORTED BY THE MX 48 AND MX 52 UNITS.....12

III. JBUS AND MODBUS FUNCTIONS.....13

IV. DETAILS OF THE FRAMES USED BY THE MX48 AND MX52 UNITS.....13

V. COMPUTATION OF THE CRC16.....18

VI. CENTRAL STRUCTURE.....18

VII. "CHANNEL" STRUCTURE.....21

VIII. WIRING OF THE RS 232 OUTPUT.....25

IX. WIRING OF THE RS 485 OUTPUT.....26

INTRODUCTION

OLDHAM's type **MX48** and **MX52** detection units can be connected to an "**RS 485**" network. The protocol employed is **Jbus/Modbus**.

This protocol comprises multiple instructions, but the MX48 and MX52 units utilize only some of them.

The units operate as slaves and they respond to requests issued by one master connected up to the same network.

IMPORTANT

Refer to the manual D 813 580 to find all the instructions required for using the MX52 controller.

I. THE Modbus PROTOCOL

1. Definition of a protocol

1.1. General features

The exchange of data between computer systems, programmable controllers and other intelligent systems must be done in the simplest possible common language understood by each party. Nevertheless, it must be possible to check each exchange so as to ensure the integrity of the transfers. The variables exchanged are then inserted into a frame which is generally made up as follows:

Header":" / Address / Request / Data / Check / End

Each protocol defines the presence, format and contents of the various groups of variables surrounding the data area.

This structure makes it possible to define the start of messages, their size, possibly the system to which the data are addressed, the type of function requested, the variables themselves, a check parameter and an end code validating the complete message.

This frame differs in its contents and form for each type of protocol.

Modbus/Jbus FRAME

In RTU mode, the frame defined for the Modbus protocol contains neither a header byte nor an end-of-message byte. It is defined as follows:

Address / Request / Data / CRC 16

CRC 16: Cyclic redundancy check.
In ASCII mode, the frame is complete and is defined as follows:

Header":" / Address / request / Data / LRC / End «CRLF»

LRC: Longitudinal redundancy check,

CR: Carriage return,

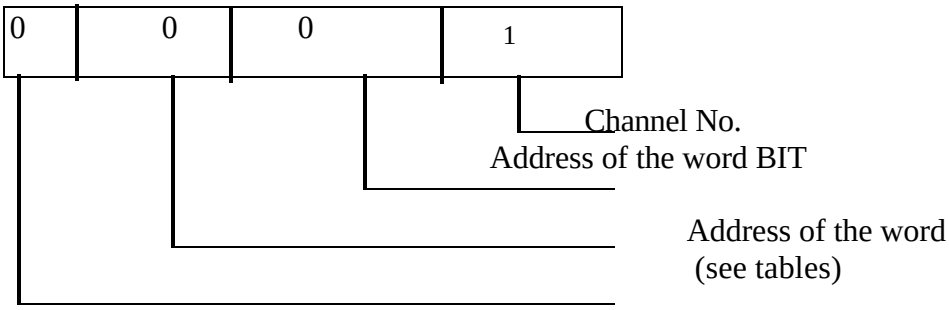
LF: Line feed.

Jbus PROTOCOL

The Jbus protocol uses functions identical to those of Modbus, so that these common functions enable Modbus equipment to communicate with Jbus equipment.

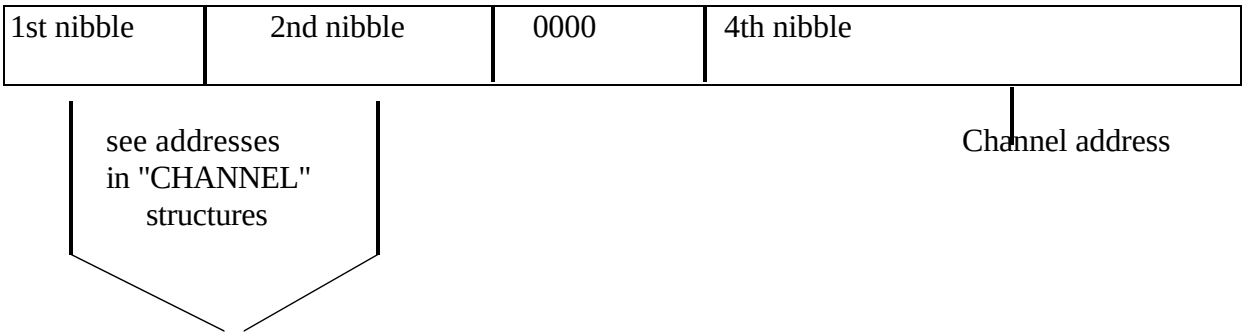
In the **MX 48** and **MX 52** units, the address of the words in BITS is as follows:

*BIT addressing (**function 05**)

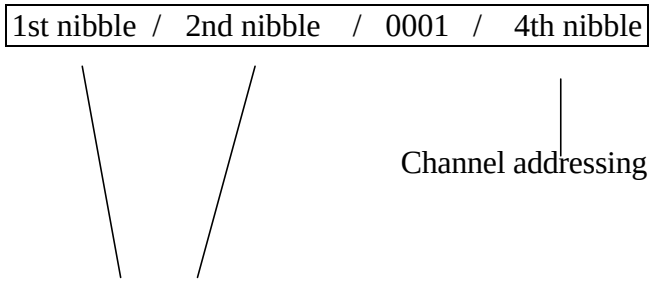


Addressing of the words

***SERIAL addressing:** (makes it possible to read consecutive data from one channel)



***PARALLEL addressing:** (makes it possible to read the same data item on several channels).



See address in "CHANNEL" structures.

2. OUTLINE of the Modbus protocol

2.1. BASICS

The Modbus protocol is a dialogue protocol which creates a hierarchical structure (a master and several slaves)**.**

The Modbus protocol makes it possible to interrogate one or more intelligent slaves from the master.
A multipoint link interconnects the master and slaves.

Two types of dialogue are possible between master and slaves:

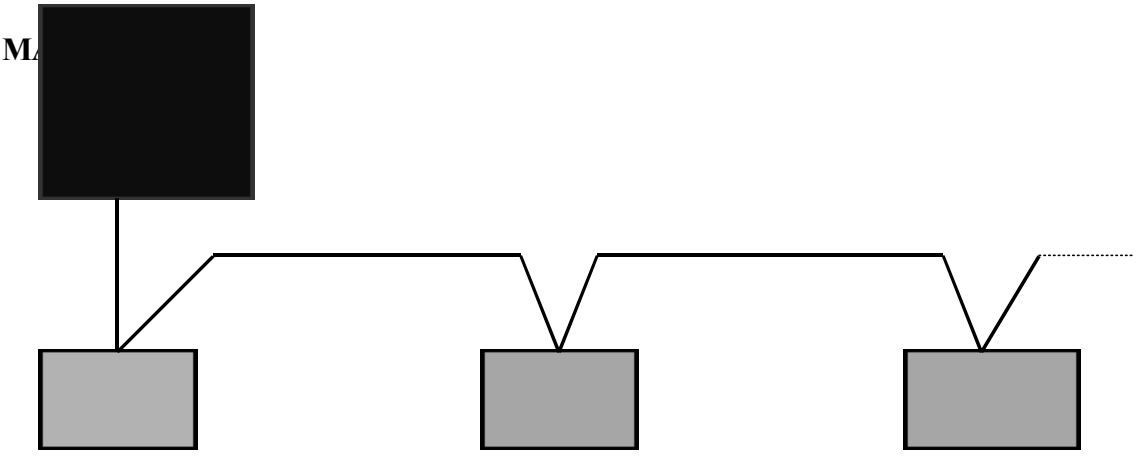
*The master speaks to a slave and waits for his response,

*The master speaks to all the slaves without waiting for a response (the principle of general broadcasting).

The master manages the exchanges on its initiative alone. This master repeats the question when the exchange is erroneous and decrees is the interrogated slave that is absent if there is no response within a given time.

There can only be one item of equipment transmitting over the line.

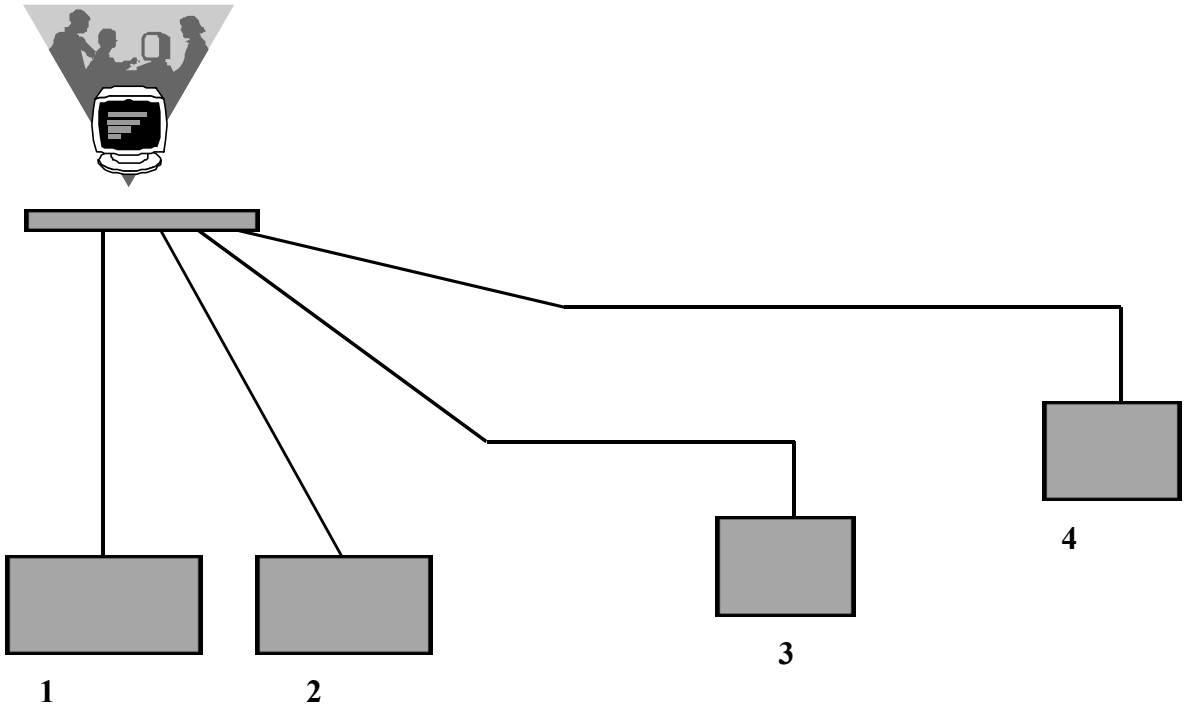
No slave can send a message without "permission"!



slave 1 slave 2 slave X

The basics of master/slave dialogue can be schematized in the form of a succession of point-to-point links.

The master manages the position of a fictitious switch which may be likened to the No. of the destination selected.



SLAVES

Any sideways communication (slave to slave) can exist only if the master's application software was designed to receive data and resent them from one slave to another.

3. Basics of Modbus exchanges

The Modbus protocol makes it possible to exchange data (bits and words) between a master and slaves and checks the exchanges.

Accordingly, bit areas and word areas are defined in each slave entity and will be read or written by the master.

The Modbus protocol being defined, a Modbus address must be associated with each object (bit or word) for access thereto.

- An input object can only be read.
- An output object can be read and written.

II. PROTOCOL MANAGEMENT

1. Images of the Modbus objects

1.1. Definition

The protocol defines four types of accessible objects:

- input bits,
- output bits,
- input words,
- output words.

Any slave attached to a Modbus line defines a number of objects for each type.

Within the same entity, all the objects are labelled by consecutive addresses.

Bit objects

The Modbus address of the first bit configured must necessarily correspond to the bit of rank 0 of an internal word. The other bits are consecutive with the first.

Word objects

All the word objects are located in the internal word area of the controller.

2. Master/slave exchanges

2.1. Basics

The exchanges are under the initiative of the master, or supervisory module. This master will address a slave by providing it with four types of information:

- Address of the slave,
- Function requested of the slave,
- Data area (variable depending on the request),
- Exchange check.

The master of the link waits for the slave's response before sending the next message, thus avoiding any conflicts on the line. Hence, this allows half-duplex operation.

Checking the exchanges

Any management of the exchanges between two entities talking via an asynchronous serial link obviously includes exception responses when exchange faults have appeared. Various inconsistent messages may arrive at the slave. In this case, the latter informs the master of his non-comprehension and the latter may or may not decide to repeat the exchange.

3. Details of the functions supported by the MX 48 and MX 52 units.

*Reading of N output bits

code 01: function not used.

*Reading of N input bits

code 02: function not used.

*Reading of N output words

code 03: this function makes it possible to read output words (words which can be read or written), defined in the memory of a slave.

*Reading of N input words

code 04: this function, identical to the above, possesses the same limits and is addressed at input words (words which the master can only read).

*Writing of an output bit

code 05: this function makes it possible to set an output bit to 0 or 1 (those bits which are write-accessible only) defined in the memory of a slave.

*Writing of an output word

code 06: this function writes a 16-bit output word (those which are write-accessible only) defined in the memory of a slave.

*Writing of N output bits

code 15: this function is not used.

*Writing of N output words

code 16: this function allows the master to write output words (words which can be read or written) to the memory of a slave.

III. Jbus and Modbus FUNCTIONS

Certain functions used by **Jbus** and by **Modbus** are common, while others show differences.

OLDHAM's type **MX 48** and **MX 52** detection units use functions which are common to **Jbus** and **Modbus .**

The **MX 48** and **MX 52** units transmit messages in **RTU mode**.

The transmission parameters are:

- No parity,
- 8 data bits,
- 1 stop bit,
- rate selectable at the unit (1200,2400,4800,9600,19200 baud),
- slave No. selectable at the unit.

IV. Details of the FRAMES used by the MX48 and MX52 units

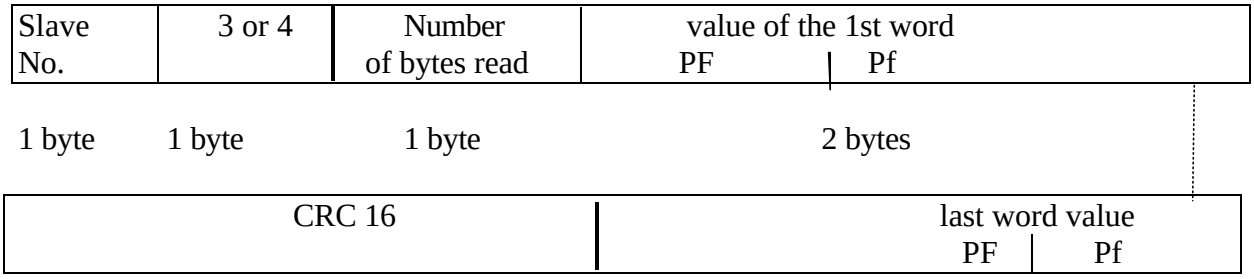
*Reading of N bits (function 1 or 2): not used

* Reading of N words: function 3 or 4

QUESTION

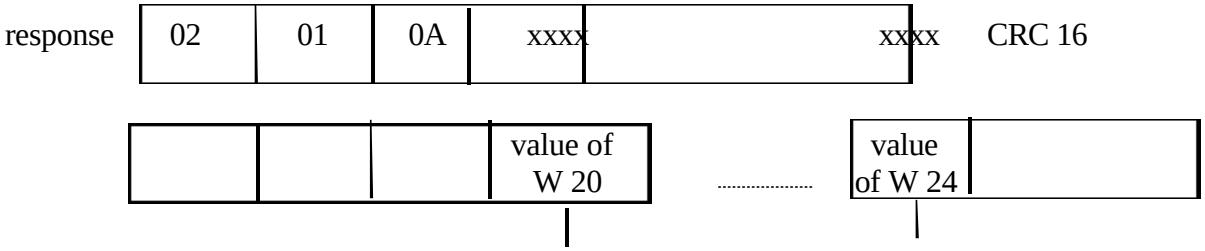
Slave No.	3 or 4	No. of 1st word		number of words		CRC16
		PF	Pf	PF	Pf	
1 byte	1 byte	2 bytes		2 bytes		2 bytes

RESPONSE



Example: reading words w20 to w24 of slave 6

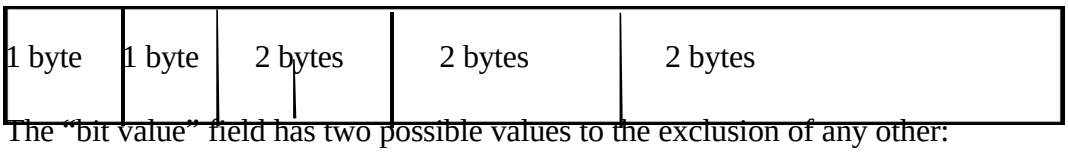
question 06 04 14 05 CRC 16



*Writing of an output bit: function 5

QUESTION

Slave No. 5 bit No. Pf Pf bit value CRC 16



The "bit value" field has two possible values to the exclusion of any other:

$bit at 0=0000,

$bit at 1 = FF00.

REPONSE

Slave No.	5	bit No. PF	Pf	bit value	CRC 16

1 byte 1 byte 2 bytes 2 bytes 2 bytes

Example: writing the value 1 into bit B3 of slave 2

question	02	05	03	FF00	CRC 16
Response	02	05	03	FF00	CRC 16

*Writing an output word: function 6

QUESTION

Slave No.	6	word No. PF	Pf	word value PF	Pf	CRC 16

1 byte 1 byte 2 bytes 2 bytes 2 bytes

RESPONSE

Slave No.	6	word No. PF	Pf	word value PF	Pf	CRC 16

1 byte 1 byte 2 bytes 2 bytes 2 bytes

Example: writing the value 3A15 into word W12 of slave 5

Question	05	06	0C	3A15	CRC 16
Response	05	06	0C	3A15	CRC 16

*Reading the exception status (function 7): not used

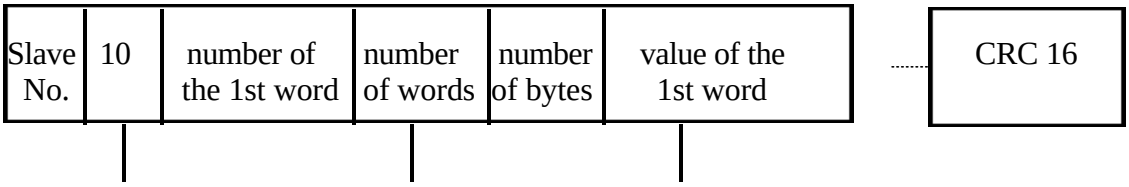
*Reading the events counter (function 11): not used

*Reading the log-on events (function 12): not used

*Writing N output bits (function 15): not used

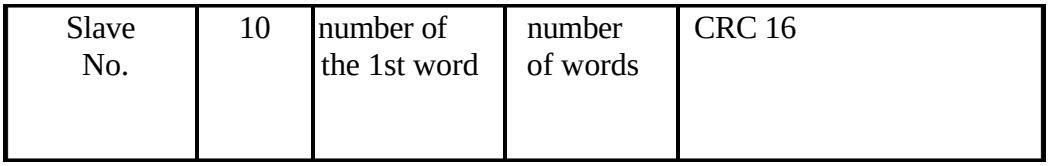
*Writing N output words: function **16**

QUESTION



1 byte 1 byte 2 bytes 2 bytes 1 byte 2 bytes 2 bytes

RESPONSE



1 byte 1 byte 2 bytes 2 bytes 2 bytes

Example: writing the values 1 and 2 into words W16 and W17 of slave 11

Question	0B	10	0010	0002	04	0001	0002	CRC16

Response	0B	10	0010	0002	CRC16

Exception responses

An exception response is returned by a slave when the latter cannot execute the request addressed to it.

Error message:

In the case of wrong transmission, a data error or a processing problem, the unit can return two types of messages.

* **Checksum error:** the checksum received by the unit is wrong.

* **Function error**: the arguments received by the unit are wrong (non-existent function, attempt to write to an area reserved for reading only etc.).

→ Response from the slave in respect of unknown function code:

Slave No. XX 01 CRC16
function code+80H

→ Response from the slave in respect of incorrect address

Slave No. XX 02 CRC16
function code+80H

→ Response from the slave in respect of incorrect data item

Slave No. XX 03 CRC16
function code+80H

Format of an exception response:

Slave No.	response code	error code	CRC16
1 byte	1 byte	1 byte	1 byte

V. COMPUTATION of the CRC16

The **CRC16** is computed on all the bytes of the message by applying the following method:

* initialize the CRC (16-bit register) to H'FFFF',

* do from the first to the last byte of the message:

CRC XOR <byte> --> CRC
do 8 times
shift the CRC by one bit to the right
if the bit = 1, do **CRC XOR H'A001'-->CRC**

* Do end

The **CRC** obtained will be transmitted low-order bit first followed by high-order bit.

XOR = exclusive OR.

VI. CENTRAL STRUCTURE

*READ and WRITE AREA of the UNIT

Address	Meaning
00XX	see below for definition of C.gProg
01XX	pointer to the language used =>
02XX **=> O3XX**	response time of the unit
04XX **=> 05XX**	RL1 and RL2 shutdown time (parking)

*READ-ONLY AREA of the UNIT

Address	meaning
20XX	see below for definition of C.gstatus
21XX	see below for definition of C.pstatus
22XX	see below for definition of C.update
23XX	see below for definition of C.key
24XX	currently displayed channel
25XX	channel being measured
26XX	number of measurements being made
27XX	aggregate of measurements in progress
28XX	monitor keyboard activity
29XX	monitor timed display flashing
2AXX	used by the character generator
2BXX	position of the printout character
2CXX =>34XX	version of the software

C.gprog = the unit's "general programming" word.

0001	defer/no audible alarm
0002	buzzer connected or not
0004	buzzer continuous/intermittent

C.gstatus = overal status of the unit.

0001	manual or automatic poling
0002	mode t,l loading
0004	central programming mode
0008	goes into programming mode
0010	unit in autotest mode
0020	flashing status of the display
0040	display in timed flashing mode
0080	do not update the display of measurements
0100	no automatic poling
0200	generation of printout characters mode
0400	generation of display characters mode
8000	statuses of « flashing » Leds

C.pstatus = status of the peripherals immediate to the unit.

0001	status of the WD line
0002	status of the DIR line of the RS 485
0008	buzzer of the unit
1000	buzzer defered
0040	common fault relay
0080	common relay 3

C.update = update request word.

0001	update the display
0002	update the average measurements
0004	update the I2C facilities
0008	auto-poling of the channel on display
0010	update the immediate peripherals
0020	conversion terminated
0040	restart the measurements
0080	set flashing
0100	update the alarms
4000	the Jbus has written to memory

C.key = status of the keypad
Adr Jbus = 4BXX READ mode only

0000	no event
0001	test/enter key
0002	programming key
0004	calibration key
0008	"plus" key (right)
0010	"minus" key (left)
0018	plus and minus key
0020	receipt key

VII. "CHANNEL" STRUCTURE.

Remark

The size of the CHANNEL structure must necessarily be even, otherwise the Jbus addressing functions would pose a problem.

*CHANNEL READ and WRITE AREA

address	meaning
50XX	see below for definition of C.V[X].gprog
51XX	see below for definition of C.V[x].rprog
52XX	user measurement range
53XX	pointer to the range used
54XX	
=>56XX	programmed thresholds for the alarms
57XX	pointer to the channel label
58XX	pointer to the unit used
59XX	pointer to the gas used
5AXX	
=>5FXX	alarm programming time
60XX	simulated channel measurement
61XX	position of the decimal point
62XX	
=>64XX	label, l, user gas
65XX	
=>67XX	unit, user
68XX	
=>6FXX	label, l, user channel

*CHANNEL READ-ONLY AREA

90XX	see below for definition of C.V[X].gstatus
91XX	see below for definition of C.V[X].astatus
92XX	see below for definition of C.V[X].rstatus
93XX	currently active range
94XX	instantaneous measurement
95XX	average measurement
96XX	see below for definition of C.V[X].dip
97XX	flashing of the leds, ditto C.V[X].dip
98XX	channel on / off monitoring
=>99XX	
9AXX	monitoring of the alarm steps
=>9FXX	
A0XX	monitoring of the fault steps
=>A1XX	
A2XX	monitoring of the fault steps
=>A3XX	
A4XX	monitoring of the relay steps
=>A9XX	
AAXX	monitoring of the buzzer defer steps
=>ABXX	

C.V[x].gprog = general programming bits of a channel

0001	the channel accepts autocalibration
0002	automatic acknowledgement alarm 1
0004	automatic acknowledgement alarm 2
0008	alarm 3 on average
0010	alarm 1 per decrease
0020	alarm 2 per decrease
0040	alarm 3 per decrease
0080	parking cycle
0100	toxin sensor (4-20 mA)
0200	fire sensor (4-20 mA special)
8000	the channel is programmed to be on

C.V[x].rprog = programming bits for the relays of a channel

0001	relay 1 positive safety
0002	relay 2 positive safety
0010	relay 1 set to 0
0110	relay 1 set to 1
0020	relay 2 set to 0
0220	relay 2 set to 1
0040	relay 3 set to 0
0440	relay 3 set to 1
0080	fault relay set to 0
0880	fault relay set to 1

C.V[x].gstatus = overall status of a channel

0001	electronic card present
0002	channel in programming mode
0004	channel in copy mode
0008	channel in simulation mode
0010	channel in calibration mode
0020	channel in manual calibration
0040	channel in low fault
0080	channel in high fault
0100	channel in alarm 1
0200	channel in alarm 2
0400	channel in alarm 3
0800	fault not acknowledged
1000	alarm 1 not acknowledged
2000	alarm 2 not acknowledged
4000	alarm 3 not acknowledged
8000	the channel is ready

C.V[x].astatus = status bits of the fault alarms

0001	low fault threshold reached
0002	low fault reached
0004	high fault threshold reached
0008	high fault active
0010	alarm 1 threshold reached
0020	alarm 1 active
0040	alarm 2 threshold reached
0080	alarm 2 active
0100	alarm 3 threshold reached
0200	alarm 3 active
0400	autocalibration threshold reached
0800	autocalibration threshold active

C.V[x].rstatus = intermediate-status bits for the relays

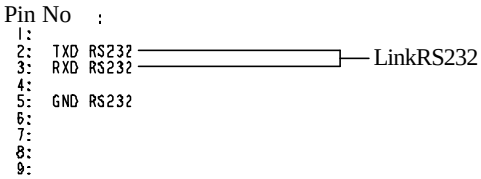
0001	common fault relay
0002	relay 1
0004	relay 2
0008	common relay 3
0100	buzzer
0200	buzzer defered
0000	parking mode level 0
1000	parking mode level 1
2000	parking mode level 2
3000	parking mode level 3
F000	reserved for parking mode

C.V[x].dip=statuses of the facilities on the analogue card C.V[x].blink=statuses of the flashing leds

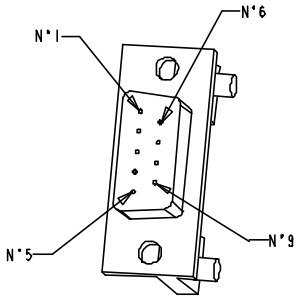
0001	alarm 1 relay
0002	alarm 2 relay
0004	alarm 1 led
0008	alarm 2 led
0010	alarm 3 led
0100	channel on/off
0200	1 mA setting
0400	2 mA setting
0600	greater than 20 mA setting
0800	fault led
1000	A/B channel selection

VIII. WIRING OF THE RS 232 OUTPUT

(Connector located at the rear of the MX48 and MX52 unit on the micro circuit)



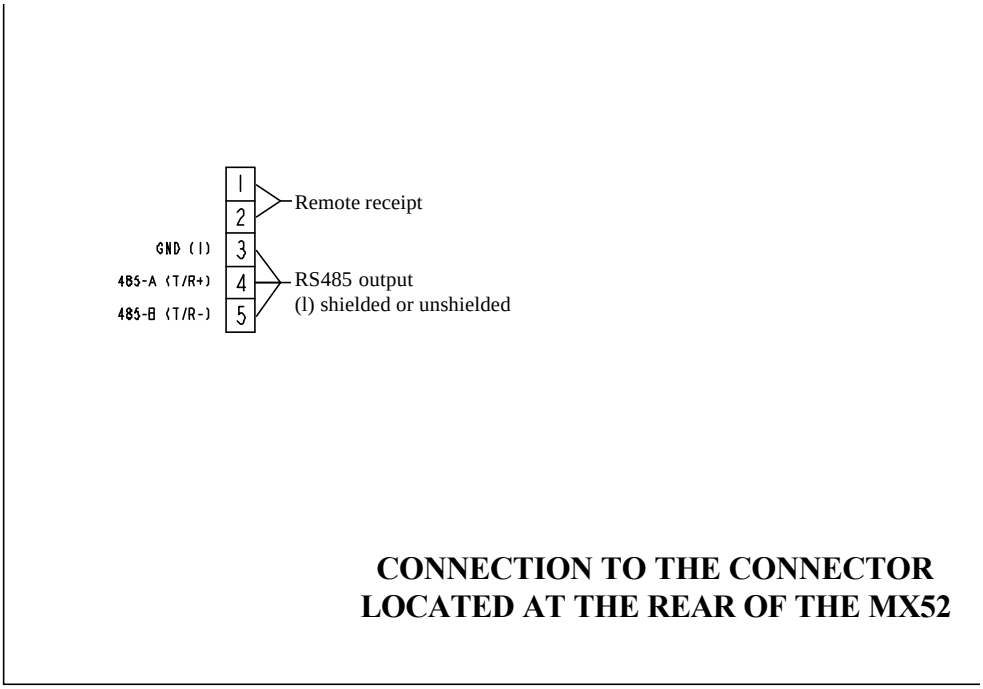
If you wish to use the RS485 link, the male DB9 "plug" connector must be connected to the female DB9 connector (internal strap between 3 and 4)



PIN LAYOUT FOR THE RS 232 SERIAL LINK CONNECTOR

IX. WIRING OF THE RS 485 OUTPUT

(Connector located at the rear of the MX48 and MX52 unit,
on the « micro » circuit)



**CONNECTION TO THE CONNECTOR
LOCATED AT THE REAR OF THE MX52**

CARD NI (National Instrument) INSTALLATION

Win 95 / 98

Put the floppy supply with card NI
Throw setup.exe
Answer yes to different question
For the card will install on com5 and com6
Stop PC and insert the floppy card NI in a slot PCI
Take off PC
In program detail, National Instrument serial, throw NI diagnostic. The result has to be PASS
In program parameter, configuration, system, peripheral of management, port COM + LPT, communication port COM5, property, parameter, put control of no flood (None), in detail hold out to put 2 wires, TXRX auto rdy.

Win NT

Put the floppy supply with card NI
Throw setup.exe
Answer yes to different questions
For the card will install on com5 and com6
Stop PC and insert the floppy card NI in a slot PCI
Take off PC
In program detail, National Instrument serial, throw NI diagnostic. The result has to be PASS
In program parameter, NI, communication of port COM5, settings to put 2 wires, TXRX auto rdy.

CONNECTIONS

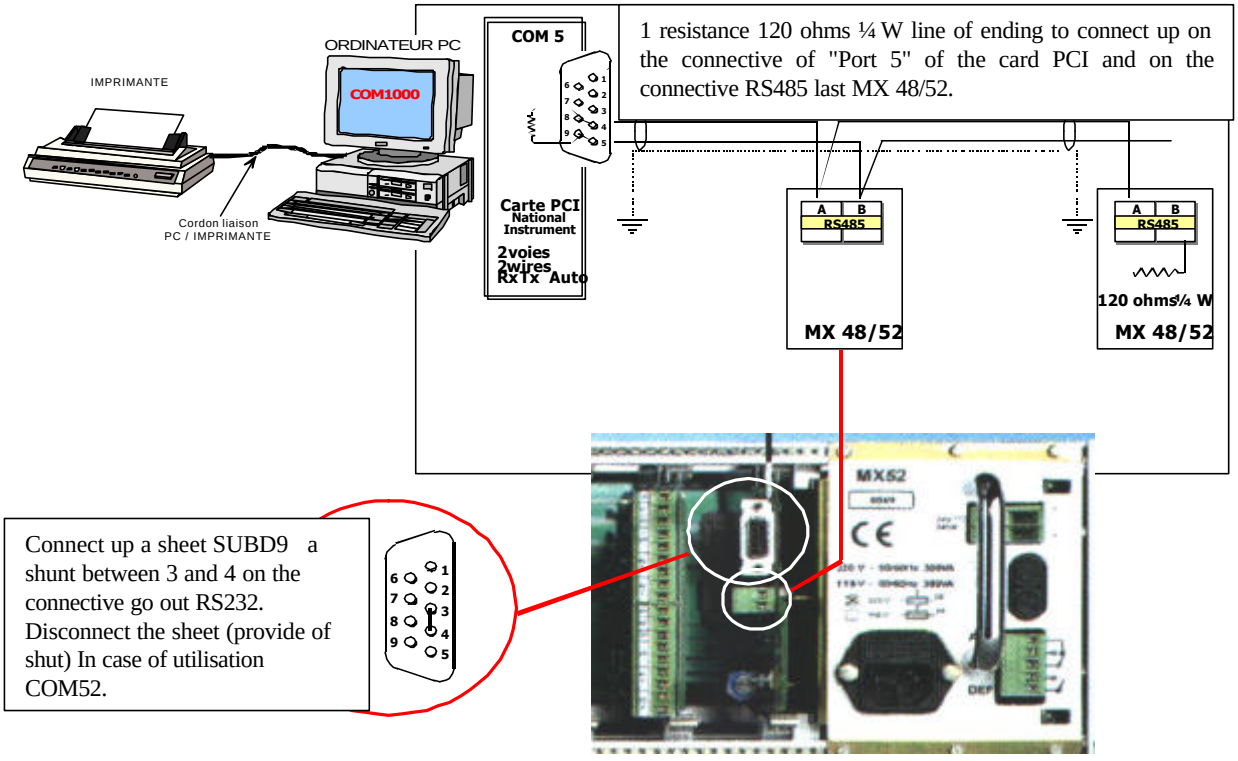
COMPUTER ENVIRENNENT NECESSARY

Computer IBM PC or compatible PC

- capable to hold up WINDOWS NT, Win 95 and upper (400 MHZ, 120 MO of RAM, potential memory =300)
- Fit out of a graphics scream the minimum configuration 800x600 pixels in 256 colours (17 pouces)
- Fit out of a card RS485 – 2 ports (PCI 485/2 of National Instruments)

CHARACTERISTIC OF THE SERIES CONNECTION
PC ⇨ Measurement of central

Cable armoured 2 or 3 wires.
Wires twist 6/10^{éme}.
Maximum length


IMPRIMANTE
ORDINATEUR PC
COM1000
Cordon liaison PC / IMPRIMANTE
COM 5
Carte PCI National Instrument
2voies 2wires RxTx Auto
1 resistance 120 ohms ¼ W line of ending to connect up on the connective of "Port 5" of the card PCI and on the connective RS485 last MX 48/52.
A B RS485
MX 48/52
A B RS485
120 ohms¼ W
MX 48/52
Connect up a sheet SUBD9 a shunt between 3 and 4 on the connective go out RS232. Disconnect the sheet (provide of shut) In case of utilisation COM52.
MX52

OLDHAM s'engage - OLDHAM undertakes

Parce que la sécurité des hommes et la protection de l'environnement sont notre priorité, OLDHAM s'engage et définit ses normes qualité :

Because safety for personnel and protection of the environment are our priorities, OLDHAM gives the following undertakings and defines its quality standards :

1 Les Plus

OLDHAM s'engage au travers de son personnel qualifié, à répondre rapidement et efficacement à vos besoins de conseil, de suivi de commande, et ce, partout dans le monde.

OLDHAM s'engage à répondre dans les plus brefs délais à toutes questions d'ordre technique.

2 Qualité

OLDHAM s'engage à vous assurer une qualité de produits et de services à la hauteur de vos exigences, conformément au cahier des charges de la norme **ISO 9001** et **ATEX**.

3 Fiabilité & Contrôles

OLDHAM s'engage à vous fournir un matériel fiable. La qualité de notre production est une condition essentielle à cette fiabilité. Elle est garantie grâce à des vérifications très strictes réalisées dès l'arrivée des matières premières, en cours et en fin de fabrication (tout matériel expédié est configuré selon vos besoins).

4 Mise en service

OLDHAM s'engage, si vous le désirez, à la mise en service de votre matériel par nos techniciens spécialisés. Un gage de sécurité supplémentaire.

5 Formation

OLDHAM s'engage à faire disposer aux utilisateurs de ses produits, d'un service de formation complet : plusieurs ingénieurs pédagogues, salle de conférences, matériels disponibles pour les manipulations, matériel informatique et de visualisation, etc.

6 Contrat d'entretien

OLDHAM s'engage à vous proposer des contrats d'entretien évolutifs au regard de vos besoins pour vous garantir une parfaite sécurité :

- une ou plusieurs visites par an, garantie totale ou partielle,
- renouvelable par tacite reconduction,
- incluant le réglage des centrales de mesure, l'étalonnage des appareils et le contrôle des asservissements.

7 Dépannage sur site

OLDHAM s'engage à faire intervenir ses techniciens du **Service Après Vente** rapidement. Ceci est possible grâce à la répartition judicieuse de nos agences en **France** et de nos agents à l'étranger.

8 Dépannage en usine

OLDHAM s'engage à traiter tout problème qui ne pourrait être résolu sur site par le renvoi du matériel en usine. Des équipes de **techniciens spécialisés** seront mobilisées pour réparer votre matériel, dans les plus brefs délais, limitant ainsi au maximum la période d'immobilisation.

Pour toute intervention du Service Après Vente en France, un numéro Indigo a été mis en place : le 0 825 842 843

1 *Strong points*

*Through its qualified personnel, **OLDHAM undertakes** to respond to your needs for advice and order follow-up services wherever in the world you may be.*

***OLDHAM undertakes** to answer all your technical questions as quickly as possible.*

2 *Quality*

***OLDHAM undertakes** to provide you with products and services of a quality that meets your requirements, in accordance with the specifications of **ISO 9001** and **ATEX** standards.*

3 *Reliability and inspections*

***OLDHAM undertakes** to supply you with reliable equipment. The quality of our production is essential to achieve reliability. Quality is ensured by extremely strict verifications carried out as soon as raw materials are received, during production and at the end of manufacture (all shipped equipment is configured to meet your requirements).*

4 *Start-up*

***OLDHAM undertakes** that our expert technicians will start up your equipment, if you so wish. This gives you the guarantee of additional safety.*

5 *Training*

***OLDHAM undertakes** to provide the users of its products with a complete training service : a number of engineers specialized as instructors, conference rooms, equipment available for practical exercises, computer equipment, display equipment, etc.*

6 *Maintenance contract*

***OLDHAM undertakes** to offer you open-ended maintenance contracts according to your needs so as to give you the guarantee of complete safety :*

- *one or more visits a year, comprehensive or partial warranty,*
- *renewal by tacit agreement,*
- *including the adjustment of measuring units, the calibration of equipment and the verification of servo-control systems.*

7 *Field servicing*

***OLDHAM undertakes** to send out its **After-Sales Service** technicians quickly for servicing on your site. This is made possible by the efficient network of our branches throughout **France** and other countries.*

8 *Factory repairs*

***OLDHAM gives the undertaking** that any problem that cannot be solved in the field will be dealt with by the return of the equipment concerned to our factory. Teams of **specialized technicians** are on hand to ensure the immediate repair of your equipment in the shortest possible time, so keeping downtimes for your equipment to a minimum.*

For any specific technical question, please contact our After-Sales Service (M. Miguel RIESGUO) : 00 33 3 21 60 80 80

OLDHAM

DETECTION GAZ / MESURE A L'EMISSION
GAS DETECTION / STACK GAS MONITORING

AUDACE - 03 21 135 600

Usine et siège social :
Z.I. Est - rue Orfila
B.P. 417 - 62 027 ARRAS Cedex FRANCE
Tél. : 03 21 60 80 80 - Fax : 03 21 60 80 00
E-mail : information@oldham.fr

www.oldham.fr

Plant and head office :
Z.I. Est - rue Orfila
B.P. 417 - 62 027 ARRAS Cedex FRANCE
Tél. : 33 3 21 60 80 80 - Fax : 33 3 21 60 80 00
E-mail : export.department@oldham.fr

OLDHAM BELGIUM Belgium	OLDHAM DO BRASIL Brasil	OLDHAM CS Česká Republica	OLDHAM ROMANIA Romania	OLDHAM CH Switzerland	OLDHAM GAS DETECTION Ltd UK	OLDHAM GmbH WINTER Deutschland
(33) 03 21 60 81 20	(55) 11 50 34 03 12	(42) 02627 6476	(40) 21 222 4846	(41) 26 652 51 18	(44) 0 1782 20 8020	(49) 231 924 10
(33) 03 21 60 81 02	(55) 11 50 34 12 80	(42) 0222 728296	(40) 21 222 5037	(41) 26 652 51 19	(44) 0 1782 20 8228	(49) 231 924 125
oldham.belgium@oldham.fr	oldham.brasil@uol.com.br	oldham@telecom.cz	eduard.docolin@fx.ro	info@oldham.ch	sales@oldham.biz	info@winter-gaswarn.de